

Original Research Article

Assessment of Soil Fertility of Some Villages Soils of Saharsa, Bihar, India

ABSTRACT

Assessment of soil fertility is essential to help identify strategies for sustainable agricultural production system that decreases the negative environmental impact and economic costs. This research was conducted to investigate the soil fertility status of soils of five different villages of Mahishi block of Saharsa district, Bihar, India. A total of 100 numbers of surface soil samples (0-15 cm) comprising of 20 composite soil samples from each site were collected. Collected soil samples were analysed for pH, electrical conductivity, soil organic carbon, available (nitrogen, phosphorus, potassium, sulphur, zinc, iron, copper and manganese). Results revealed that pH, electrical conductivity, organic carbon, available N, P, K and S ranged with a mean value of (7.20, 7.23, 7.33, 7.41 & 7.45), (0.52, 0.53, 0.54, 0.49 & 0.55 dSm⁻¹), (0.53, 0.48, 0.51, 0.56 & 0.54 per cent), (315, 320, 280, 361 & 325 kg N ha⁻¹), (30.92, 30.12, 28.30, 29.08 & 27.53 kg P ha⁻¹), (217, 234, 190, 204 & 210 kg K ha⁻¹) and (15.79, 16.05, 16.26, 17.37 & 17.89 mg S kg⁻¹) for Sonkurthua, Ghoghpur, Baghaud, Naharwar and Maina villages. Hence, various effects viz. use of biofertilizers, organic manure and balanced chemical fertilization were suggested for farmers regarding the benefits of improving soil fertility.

Where is the soil fertility assessment ?

Key Words: *Fertility Status, testing, Macro nutrients, Micro nutrients*

INTRODUCTION

Soil fertility plays a key role in increasing crop production in soil. It comprises not only in supply of nutrients but also their efficient management (Kothyari *et al.* 2018). Soil fertility is dynamic natural property and it can change under the influence of natural and human induced factors (Singh *et al.* 2018). At present, the greatest challenges before Indian agriculture is to boost food production and productivity as well as agricultural sustainability. There are problems that impose limits on these objectives or goals which raise serious concern about national food security. Soil fertility is one of the major constraints in achieving high productivity goals (Patidar *et al.* 2017). The most important constituent of soil is organic matter, an appreciable amount of organic matter in soil tremendously increase soil fertility.

Available Nitrogen, phosphorus and other nutrients can be increased after the decomposition of soil organic matter. Availability of macro, and micro nutrients induce better germination of seed and hence subsequent better growth and stronger root development. Soil fertility is the result of interaction among physical, chemical and biological properties of soil which is directly related to agricultural production (Rakesh *et al.* 2012). Soil fertility depletion is a major concern worldwide, because it affects the sustainable agricultural production (Barooah *et al.* 2020). Soil fertility deterioration mostly occurs due to improper land use, adverse climatic conditions and intensive cropping without adequate use of nutrients and improper soil management practices. Imbalanced and inadequate use of fertilizers may also deplete soil fertility. Evaluation of soil fertility is essential to provide nutrients for optimum crop growth. It also helps in judicious and efficient use of nutrients in local as well as the regional level. Therefore, it is necessary to assess the fertility status of soil before crop planning. The objective of present investigation was evaluating the soil fertility status in five villages of Mahishi block of Saharsa district in Bihar

(what about the previous works in such topic ?)

The introduction (Literature review) needs to be enriched)

Materials and Methods

Study Area

Mahishi is a block situated in the Saharsa district of northern Bihar. It is located 15 km toward west from district headquarter, Saharsa at 25°86' N, 86°46' E and 47 meter above the mean sea level. Mahishi consist of 83 villages and 20 Panchayat. It occupies a flat alluvial plain forming part of Koshi river basin. It is the major producer of best quality of corn and makhana.

Collection of soil sample

Soil samples were collected from farmers' field of different villages namely Sonkurthua, Ghoghpur, Baghaud, Naharwar and Maina at a depth of 0-0.15 m. Twenty referenced soil sample from each village were collected using GPS by adopting the standard procedures of soil sample collection (Ref.?). The collated soil samples were air dried, gently crushed, sieved using a 2 mm sieve for all analysis except organic carbon analysis, wherein the sample was sieved using a 0.5 mm sieve. The processed soil samples were preserved in polythene bag for further analysis.

The soil samples were analysed for organic carbon content (Walkley and Black, 1934), available N (Subbiah and Asija, 1956), available P (Olsen *et al.*, 1954), available K (Piper, 1966), available S (Chesnin and Yien, 1950), DTPA extractable Zn, Cu and Fe (Lindsay and Norvell, 1978), pH (1:2 Soil: Water suspension), electrical conductivity (1:2 Soil: Water suspension) (Jackson, 1973).

Most references are very out of date ?

Results and Discussion

The analysed soil data indicated the fertility status of soil of five villages of Mahishi block was presented in different tables.

Physical and chemical properties of soil

Soil pH of of Sonkurthua village varied from 6.80 to 7.60 with the mean value 7.20 (Table-2). Similarly, the pH of Ghoghpur, Baghaud, Naharwar and Maina varied from 7.01 to 7.45 with a mean value 7.23, 6.90 to 7.77 with a mean value of 7.33, 7.33 to 7.50 with a mean value of 7.41 and 7.23 to 7.68 with a mean value of 7.45, respectively. Electrical conductivity as a measure of current carrying capacity, gives a clear idea of the soluble salt present in the soil. The electrical conductivity of soil water suspension ranged from 0.45 to 0.59 dSm⁻¹ with a mean value of 0.52 dSm⁻¹, 0.51 to 0.56 with a mean value of 0.53 dSm⁻¹, 0.49 to 0.60 with a mean value of 0.54 dSm⁻¹, 0.41 to 0.58 with a mean value of 0.49 dSm⁻¹ and 0.54 to 0.57 with a mean value of 0.55 dSm⁻¹ in different villages of study area. All soil samples were non saline ? High conductivity are usually associated with clay rich soil and low conductivities are associated with sandy soil (Singh *et al.* 2018). Data presented in Table 2 shows that the mean value of organic carbon recorded under Sonkurthua, Ghoghpur, Baghaud, Naharwar and Maina villages soil were 0.53, 0.48, 0.51, 0.56 and 0.54 per cent, respectively. Low status of organic carbon in all soils were quite clear .

Macro nutrient status of the soil

Available nitrogen content were ranged from 300 - 330 with a mean value of 315, 305 - 335 with a mean value of 320, 255 - 305 with a mean value of 280, 230 - 492 with a mean value of 361 and 305 - 345 kg ha⁻¹ with a mean value of 325 kg ha⁻¹ in Sonkurthua, Ghoghpur, Baghaud, Naharwar and Maina villages, respectively (Table-3). As the organic matter content in the study area was found to be in low range, the plant available nitrogen content in soil was observed consequently low to medium. The medium nitrogen status was

noticed in some area may be due to application of N fertilizer coupled with high vegetative cover. The status of available phosphorus varied from 30.10 - 31.75 kg ha⁻¹, 28.56 - 31.69 kg ha⁻¹, 26.44 - 30.16 kg ha⁻¹, 27.20 - 30.96 kg ha⁻¹ and 26.82 - 28.25 kg ha⁻¹ in Sonkurthua, Ghoghpur, Baghaud, Naharwar and Maina villages, respectively. The original natural source of phosphorus is the mineral apatite and P released from organic matter low to medium range of soil available P under study area may be mostly affected by past fertilization, (available P is very low in these soils). The data on available potassium content in the soil were ranged from 199 - 235 with a mean value of 217 kg ha⁻¹, 211 - 250 with a mean value of 234 kg ha⁻¹, 178 - 207 with a mean value of 190 kg ha⁻¹, 188 - 221 with a mean value of 204 kg ha⁻¹ and 190 - 230 with a mean value of 210 kg ha⁻¹ for Sonkurthua, Ghoghpur, Baghaud, Naharwar and Maina villages, respectively. Low to Medium ranged of potassium in the analyzed soil samples may be due to absence of potash bearing minerals (Kothyari *et al.* 2018). Majority of the soil samples were found under medium category of sulphur (S) content. Intensive cropping, without S fertilization may lead to sulphur depletion in soil (Patra *et al.* 2012).

Micro nutrients status of the soil

The results of available micro nutrient status of the study area are furnished in table-4. The available Zn content of Sonkurthua, Ghoghpur, Baghaud, Naharwar and Maina villages varied in between 0.12 to 1.70 ppm, 0.66 to 3.15 ppm, 0.23 to 1.53 ppm, 0.31 to 1.21 ppm and 0.90 to 1.18 ppm, respectively. Zinc sufficiency in the study area may be due to low pH of the soil. Likewise, available Cu content varied with a mean value of 2.03, 1.93, 2.75, 1.85 and 2.41 ppm under different villages of Mahishi block. The available Fe content varied in between 16.56 to 62.46 ppm with a mean value of 39.51 ppm, 16.58 to 54.48 ppm with a mean value of 37.53 ppm, 19.50 to 80.40 ppm with a mean value of 49.95 ppm, 27.76 to 85.22 ppm with a mean value of 56.49 ppm and 35.16 to 46.56 ppm with a mean value of 40.86 ppm in Sonkurthua, Ghoghpur, Baghaud, Naharwar and Maina villages, respectively. Similarly, available Mn content under different villages of the study area ranged with a mean value of 11.85, 8.08, 11.32, 8.49 and 6.25 ppm, respectively.

Conclusion

It is observed from the study area that soils of all the villages of the study area was neutral in reaction with normal electrical conductivity and soil organic carbon varied from low to medium. Available nitrogen, phosphorus, potassium and sulphur were found in medium category. On the category, available zinc, copper, iron and manganese was medium

to high in all the soils of the study area. Therefore, regular and site specific nutrient management practices, application of balanced organic and inorganic nutrients, proper cropping system and adequate agronomic are essential to enhance the soil fertility as well as for sustainable crop production.

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Table 1: Methods adopted for estimation of different soil properties

Sl. No.	Parameters	Applied Methods
1.	Soil pH	Jackson (1973)

2.	Electrical Conductivity	Jackson (1973)
3.	Organic Carbon	Walkley and Black (1934)
4.	Available N	Subbiah and Asija (1956)
5.	Available P ₂ O ₅	Olsen <i>et al.</i> (1954)
6.	Available K ₂ O	Piper (1966)
7.	Available S	Chesnin and Yien (1950)
8.	Available Zn	Lindsay and Norvell (1978)
9.	Available Fe	Lindsay and Norvell (1978)
10.	Available Cu	Lindsay and Norvell (1978)
11.	Available Mn	Lindsay and Norvell (1978)

Table 2: Physico-chemical properties of soil of the study area

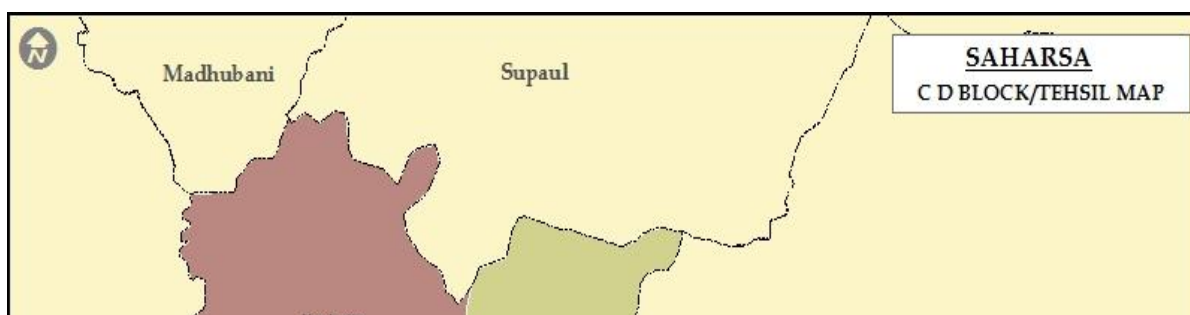
Name of village	pH		Electrical Conductivity (dSm ⁻¹)		Organic Carbon (%)	
	Range	Mean	Range	Mean	Range	Mean
Sonkurthua	6.81 - 7.60	7.20	0.45 - 0.59	0.52	0.50 - 0.56	0.53
Ghohpur	7.01 - 7.45	7.23	0.51 - 0.56	0.53	0.42 - 0.55	0.48
Baghaud	6.90 - 7.77	7.33	0.49 - 0.60	0.54	0.49 - 0.53	0.51
Naharwar	7.33 - 7.50	7.41	0.41 - 0.58	0.49	0.54 - 0.59	0.56
Maina	7.23 - 7.68	7.45	0.54 - 0.57	0.55	0.51 - 0.58	0.54

Table 3: Macro nutrient content of soil of study area

Name of village	Available N (kg ha ⁻¹)		Available P ₂ O ₅ (kg ha ⁻¹)		Available K ₂ O (kg ha ⁻¹)		Available S (mg kg ⁻¹)	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Sonkurthua	300 - 330	315	30.10 - 31.75	30.92	199 - 235	217	15.20 - 16.38	15.79
Ghohpur	305 - 335	320	28.56 - 31.69	30.12	211 - 258	234	15.50 - 16.60	16.05
Baghaud	255 - 305	280	26.44 - 30.16	28.30	173 - 207	190	15.00 - 17.52	16.26
Naharwar	230 - 492	361	27.20 - 30.96	29.08	188 - 221	204	16.90 - 17.85	17.37
Maina	305 - 345	325	26.82 - 28.25	27.53	190 - 230	210	17.10 - 18.69	17.89

Table 4: Micro nutrients content of soil of study area

Name of village	Available Zn (ppm)		Available Cu (ppm)		Available Fe (ppm)		Available Mn (ppm)	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Sonkurthua	0.12 - 1.70	0.91	0.98 - 3.09	2.03	16.56 - 62.46	39.51	6.68 - 17.01	11.85
Ghohpur	0.66 - 3.15	1.90	1.41 - 2.45	1.93	16.58 - 58.48	37.53	4.16 - 12.00	8.08
Baghaud	0.23 - 1.56	0.89	1.35 - 4.16	2.75	19.50 - 80.40	49.95	6.04 - 16.61	11.32
Naharwar	0.31 - 1.21	0.76	0.91 - 2.79	1.85	27.76 - 85.22	56.49	3.40 - 13.58	8.49
Maina	0.90 - 1.18	1.04	1.81 - 3.01	2.41	35.16 - 46.56	40.86	4.73 - 7.78	6.25



UNDER PEER REVIEW

Fig. 1 : Map of Saharsa district